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## CLAIMS

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### [Claim(s)]

[Claim 1] The material for shadow masks for the color picture tubes characterized by consisting Mn of low-carbon steel included 0.002 to 0.012% of the weight in 0.60 % of the weight or more and aluminum.

[Claim 2] The material for shadow masks for the color picture tubes characterized by consisting of low-carbon steel which contained Mn 0.60% of the weight or more, and contained C for aluminum 0.03 or less % of the weight 0.002 to 0.012% of the weight.

[Claim 3] The material for shadow masks according to claim 1 or 2 for the color picture tubes which contains Si 0.01 or less % of the weight.

[Claim 4] The material for shadow masks according to claim 1 to 3 which contains P 0.10 or less % of the weight.

[Claim 5] The material for shadow masks according to claim 1 to 4 for the color picture tubes which contains N 0.010 to 0.020% of the weight.

[Claim 6] Claims 1-5 which contain S 0.10 or less % of the weight are the materials for shadow masks of a publication for the color picture tubes either.

[Claim 7] Claims 1-6 which contain Cu 0.001 to 0.1% of the weight are the materials for shadow masks of a publication for the color picture tubes either.

[Claim 8] Claims 1-7 which contain Cr 0.001 to 0.1% of the weight are the materials for shadow masks of a publication for the color picture tubes either.

[Claim 9] The shadow mask for the color picture tubes using the material for shadow masks according to claim 1 to 8.

[Claim 10] The color picture tube incorporating the shadow mask of claim 9.

[Claim 11] The color picture tube with which a shadow mask is attached in the vertical direction at the framework where tension is given.

[Claim 12] The color picture tube with which a shadow mask is attached in the framework after tension has been given by the vertical direction and the longitudinal direction.

[Claim 13] The color picture tube of claim 12 which has less tension of said longitudinal direction than the tension of the vertical direction.

[Claim 14] The material for shadow masks according to claim 1 to 8 with which it is made for the elongation when holding for 450 degree-Cx 60 minutes, having applied 196Ns /of load stress of 2 mm to become 0.3% or less.

[Claim 15] The shadow mask with which it is made for the elongation when holding for 450 degree-Cx 60 minutes, having applied 196Ns /of load stress of 2 to the shadow mask after including in the color picture tube mm to become 0.6% or less.

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[Translation done.]

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**DETAILED DESCRIPTION**

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**[Detailed Description of the Invention]**

**Technical field** This invention relates to the color picture tube incorporating the material for shadow masks for the color picture tubes, a shadow mask, and it. It is related with the color picture tube which included in the detail the material for shadow masks for the color picture tubes, the shadow mask, and it which have the outstanding tensile strength and elevated-temperature creep strength more.

**Background technique** The so-called curve side (dome mold) Braun tube with which the shadow mask with the mask side where the color picture tube of a shadow mask method curved slightly was attached in the framework by welding has been used conventionally. Since the material for shadow masks adopted in such a conventional method is fabricated by the dome mold, importance has been attached to press-forming nature, the configuration freezing nature which maintains the configuration at the time of a press as it is.

Since this curve side Braun tube had the trouble that an eye tends to get fatigued, by the scattered reflection of external beams of light, such as lighting, flat-ization of the Braun tube was desired. However, in a shadow mask method, when flat side-ization of the Braun tube progresses, in respect of the mask which the conventional Braun tube had adopted and which curved slightly, there is a possibility that it may become impossible to attain flat side-ization. Then, in the Braun tube of a certain shadow mask method, a mask side is completely flat-ized from the former, and development of the shadow mask material which can respond to this is desired.

Although some approaches of flat-izing a mask side in the case of the shadow mask method Braun tube are proposed, the spreading mold shadow mask method which carries out the load of the tension in the vertical direction of a shadow mask is industrially called one of the promising methods.

A spreading mold shadow mask joins the shadow mask material which carried out piercing of the predetermined dot hole pattern by etching by approaches, such as welding, to the spreading direction and hard flow, where the framework is pressurized, subsequently it removes the welding pressure of the framework, and forms tension according to the stability of the framework. in order [ then, ] to prevent generating of a secondary electron, thermal radiation, rust formation, etc. — 450—470 degrees C — 10 — 20-minute room [ about ] melanism — it has processed. the reinforcement which it excels in etching nature, and also bears tension as a property of a material for which such a spreading mold shadow mask is asked, especially melanism — it is necessary to excel in the elevated-temperature creep property at the time of processing namely, melanism — in down stream processing, it is because it heat-treats where the load of the tension by the stability of the framework is carried out to a shadow mask, so creep is occurred and extended for a shadow mask material with heat and tension. Thus, when creep elongation incorporated the shadow mask material with which it was large with the material and tension declined into the Braun tube, and completed a television receiver and sound volume was enlarged at the time of actuation, vibration of a shadow mask material became large and caused [ of the screen ] a color gap.

Although a cure, such as preparing a cushion in the loudspeaker section which adjusts the

welding pressure by the framework and which raises the rigidity of a shadow mask material and is made strong, and the supporter of the Braun tube, respectively, was considered in order to solve such a trouble conventionally, still sufficient effectiveness is not acquired.

the high intensity and the elevated-temperature creep property which the super-low carbon steel plate which patent No. 2548133 contains 40–100 ppm of N about the aperture grille type steel plate material for masks, and contains Mn 0.20 to 0.60% of the weight has — melanism — the creep elongation at the time of processing is reduced In this case, compared with the solvent atom Fe, since an atomic radius is remarkable and small, N forms an interstitial solid solution into Fe crystal lattice, and a solute atom N forms the so-called Cottrell atmosphere. melanism — in an elevated temperature like processing temperature, it is thought that it has the effectiveness that creep elongation is reduced since N in Fe produces the operation which N atoms gather for the surroundings of creep elongation, i.e., a rearrangement creep, forms a Cottrell atmosphere like clouds, and controls a motion of a rearrangement creep since the diffusion rate is quick.

JP,11-222628,A is also a proposal based on the same technical principle as the above-mentioned patent No. 2548133, and has become what avoided duplication of a patent [ No. 2548133 ] generic claim by containing 100–170 ppm of N, and containing Mn 0.10 to 0.60% of the weight.

The technical problem of this invention is to offer the color picture tube incorporating the material for shadow masks for the color picture tubes, the shadow mask, and it which have the outstanding tensile strength and the elevated temperature creep strength which can respond to the above perfect flat side Braun tubes, and is by raise the rigidity of a shadow mask material by take the measures which reduce the creep elongation of a spreading mold slot type shadow mask to solve problems, such as a color gap.

Indication of invention The most important description that this invention indicates is aiming at an improvement of a creep property by making Mn into 0.60 % of the weight or more, and making aluminum into 0.002 – 0.012 % of the weight, without reducing the level of inclusion, controls an AlN deposit and aims at an improvement of the improvement effectiveness in a creep of Dissolution N.

That is, the material for shadow masks of this invention for the color picture tubes carries out Mn 0.60% of the weight or more, and is characterized [ 1st ] by consisting of low-carbon steel which contains aluminum 0.002 to 0.012% of the weight.

It is characterized [ 2nd ] by the material for shadow masks of this invention for the color picture tubes consisting of low-carbon steel with which Mn is contained 0.60% of the weight or more, and it contains C for aluminum 0.03 or less % of the weight 0.002 to 0.012% of the weight. It is desirable to contain S 0.10 or less % of the weight, it is desirable to contain P 0.10 or less % of the weight, and it is [ it is desirable to contain N 0.010 to 0.020% of the weight and / as for said material for shadow masks for the color picture tubes, it is desirable to contain Cu 0.001 to 0.1% of the weight, and ] it is desirable to contain Si 0.01 or less % of the weight further, and desirable [ a material ] to contain Cr 0.001 to 0.1% of the weight.

The shadow mask for the color picture tubes of this invention is characterized by using the material for shadow masks of a publication for above either.

The color picture tube of this invention is characterized by incorporating said shadow mask. The color picture tube of this invention is characterized by attaching said shadow mask in the vertical direction at the framework, where tension is given.

The color picture tube of this invention is characterized by attaching said shadow mask in the framework, after tension has been given by the vertical direction and the longitudinal direction. In such the color picture tube, it is desirable for there to be less tension of said longitudinal direction than the tension of the vertical direction.

The material for shadow masks of this invention is characterized by making it the elongation when holding for 450 degree-Cx 60 minutes become 0.3% or less, applying 196Ns /of load stress of 2 mm.

The shadow mask of this invention is characterized by making it the elongation when holding for 450 degree-Cx 60 minutes become 0.5% or less, applying 196Ns /of load stress of 2 to the shadow mask after including in the color picture tube mm.

The best gestalt for inventing The shadow mask of this invention fixes on a frame the shadow mask material which adjusted and manufactured the component made to contain, where the load of the big tension in the vertical direction is carried out (for example, welding). Moreover, while it has been in the condition that the load of some tension fewer than the vertical direction was carried out also to the longitudinal direction of a frame, after the shadow mask of this invention heat-treats, the shadow mask itself slackens, and it has sufficient elevated-temperature creep strength which can hold the condition of not generating a wrinkling etc.

What it decarbonized and processed [ denitridation ], using a vacuum degassing process as low-carbon steel used as a shadow mask material of this invention, and the carbide and the nitride in steel were decreased, and was hot-rolled is desirable. First, the class of element contained in the steel used for the material of the shadow mask of this invention and the reason for limitation of the content are explained.

In order for Mn to be the important component of this invention and to raise the creep property as a spreading mold slot type shadow mask, many contents of Mn are so desirable that there are, and although a minimum is made into 0.60 % of the weight, 1.0 or less % of the weight of an upper limit is more desirable than the viewpoint of the etching nature of a manufacturing cost and a shadow mask material.

aluminum is the important element of this invention like Mn, is used in a steel-manufacture process as a deoxidizer, and has the effectiveness of improving the cleanliness of steel. For this reason, it is desirable to consider as 0.002% of the weight or more of a content. It is 0.003% of the weight or more of a content more preferably. On the other hand, in order to combine the etching property of a shadow mask material with the dissolution N in steel it not only to deteriorate, but, to be set to AlN, to reduce Dissolution N and to degrade a creep property when producing embrittlement by solid solution hardening if aluminum is contained so much, let an upper limit be 0.012 or less % of the weight of a content.

Since C dissolves in steel and increase, tensile strength, and its creep strength improve ingredient hardness, it is desirable to carry out specified quantity content. Since it will become the cause by which carbide increases and an etching property is barred if there are many amounts of C, it is desirable to make an upper limit into 0.03% of the weight of a content. As for a minimum, it is desirable to consider as 0.0001% of the weight of the content which can be reduced practical by vacuum-degassing processing or opening coil annealing (OCA) by the cube type annealing furnace. It is 0.0002% of the weight or more of a content more preferably, and is 0.0003% of the weight or more of a content still more preferably.

melanism in Si's checking the etching nature of a shadow mask material — since membranous adhesion is deteriorated, few contents are so desirable that there are, and it is desirable to consider as 0.01 or less % of the weight of a content.

As for P, it is desirable to make an upper limit into 0.10 % of the weight in order to check the etching nature of a shadow mask material.

As mentioned above, since it dissolves in steel and increase, tensile strength, and creep strength improve ingredient hardness, it is necessary to add N. In forming the nitride of further a high degree of hardness, since it has the effectiveness which prevents migration of a rearrangement creep when this nitride distributes minutely in crystal grain, it has the effectiveness of improving especially creep strength. For this reason, it is desirable to consider as 0.010% of the weight or more of a content. It is 0.012% of the weight or more of a content more preferably.

On the other hand, since a nitride will increase too much and an ingredient will be stiffened if there are many amounts of N, it is desirable to consider as 0.02 or less % of the weight of a content. It is 0.017 or less % of the weight of a content more preferably.

In segregating to a grain boundary and checking the etching property of a shadow mask material remarkably, since S causes [ of a material ] embrittlement, little way of a content is desirable and it is desirable to consider as 0.10 or less % of the weight. 0.05 more or less % of the weight of a content is desirable.

Since Cu dissolves in steel and increase, tensile strength, and creep strength improve ingredient hardness, it is desirable to carry out specified quantity content, and it is desirable to consider as 0.001% of the weight or more of a content. It is 0.002% of the weight or more of a content more

preferably, and is 0.003% of the weight or more of a content still more preferably.

On the other hand, since the etch rate of a shadow mask material will be fallen and an etching reagent will be polluted if there are many amounts of Cu(s), it is desirable to consider as 0.1 or less % of the weight of a content. It is 0.08 or less % of the weight of a content still more preferably.

Since Cr dissolves in steel and increase, tensile strength, and its creep strength improve ingredient hardness, it is desirable to carry out specified quantity content. Furthermore, Cr reacts with the dissolution nitrogen (N) which remains in steel, and since the property which forms a nitride like CrN is strong, it has the nitridation and a stabilization effect. Consequently, while reducing the blowhole in slab remarkably, creep strength increases remarkably by carrying out formation distribution of the detailed nitride. This is guessed for the resistance to creep elongation accompanied by migration of a rearrangement to increase.

For this reason, as for the minimum of Cr addition, it is desirable to consider as 0.001% of the weight or more of a content. It is 0.002% of the weight or more of a content more preferably, and is 0.003% of the weight or more of a content still more preferably. On the other hand, since carbide will be formed and magnetic properties will be checked if there are many amounts of Cr (s), it is desirable to consider as 0.1 or less % of the weight of a content. It is desirable to consider as 0.09 or less % of the weight of a content more preferably. It is 0.08 or less % of the weight of a content still more preferably.

Next, the manufacture approach of the sheet steel as a material for shadow masks of this invention is explained. By the usual melting method, the molten metal of the acquired above-mentioned presentation performs deoxidation processing by vacuum degassing, aluminum, Si, etc., and a hot-rolling plate is obtained through continuous casting and a hot rolling process. In an acid-washing process, after descaling, it cold-rolls and considers as 0.2–0.8mm board thickness. Subsequently, it finish-machines with cold rolling to 0.05–0.20mm of predetermined board thickness after softening processing by annealing processing. Even if annealing processing uses a cube type annealing furnace or a continuous annealing furnace, it does not interfere.

Next, the shadow mask of this invention is explained.

The water-soluble casein resist was applied to both sides of the shadow mask material of the presentation shown in Table 1, and pattern NINGU of the resist was carried out after desiccation using the glass film plate which drew the pattern of the front flesh side of a pair for the resist of both sides of a material. Subsequently, exposure, dura mater processing, and baking processing were performed, and it etched by spraying on both sides of the resist by which pattern NINGU was carried out from a spray by using the ferric-chloride solution of Be as an etching reagent the solution temperature of 60 degrees C, and the specific gravity of 48 degrees after that. After etching, it rinsed, and with the alkali solution, the resist was exfoliated and dried [ washed and ] and the shadow mask was produced.

Next, the condition of having attached the shadow mask of this invention in the framework is explained. The shadow mask of this invention fixes tension to the framework, where a load is carried out. Although this fixing approach has various classes, welding process is used best. In fixing, first, the core of the frame of the upper and lower sides of the framework is sagged a little compulsorily inside, and a shadow mask is fixed in this condition.

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## EXAMPLE

## (Example)

Hereafter, this invention is further explained to a detail about an example.

Vacuum degassing of the steel (A-G) which has the chemical composition of a different class is carried out, the slab which carried out the product made from \*\* is hot-rolled in Table 1, and the chemical composition at the time of considering as a 2.5mm hot-rolling plate is shown in it. It cold-rolled, after carrying out sulfuric-acid acid washing of these hot-rolling plates, and it considered as the cold-rolled plate whose board thickness is 0.35mm. Then, using the continuous system annealing furnace, annealing processing was performed and it considered as 0.10mm of board thickness with cold rolling further.

表 1

## 供試材（鋼板）の化学組成

試料 番号	化 学 組 成 (重量%)									区分
	C	Mn	Si	S	P	N	Al	Cu	Cr	
A	0.010	0.65	0.010	0.006	0.012	0.0127	0.003	0.08	0.040	本発明
B	0.024	0.68	0.010	0.007	0.012	0.0130	0.007	0.08	0.045	本発明
C	0.019	0.78	0.009	0.005	0.014	0.0148	0.005	0.06	0.055	本発明
D	0.022	0.95	0.010	0.008	0.015	0.0155	0.010	0.06	0.054	本発明
E	0.015	0.33	0.013	0.012	0.009	0.0090	0.009	0.06	0.055	比較例
F	0.021	0.36	0.004	0.008	0.013	0.0113	0.018	0.05	0.04	比較例
G	0.023	0.62	0.011	0.015	0.010	0.0124	0.032	0.03	0.050	比較例

Table 2 shows a characteristic test result collectively about the test specimen obtained by doing in this way. The tension test measured and evaluated both elongation (%) at the time of creep elongation holding in atmospheric air for 450 degree-Cx 60 minutes, having applied 2 196Ns [/mm] load stress using the creep tester (made in the Tokai factory), and elongation at the time

of repeating maintenance 3 times in atmospheric air for 450 degree-Cx 20 minutes, having applied 2 196Ns [/mm] load stress (%) by the Instron type tension tester.

This creep strength test evaluation is defined on the following criteria.

Namely, the reason for having defined the creep elongation in the column of the "property at the time of a shadow mask material" of a publication all over Table 2 to "0.3% or less" [ where the load of the tension after processing is carried out after attaching a shadow mask in a frame ] after a shadow mask is welded to a frame, heat treatment for carrying out melanism is performed — assuming — melanism — The test condition of the shadow mask material for holding the condition that the load of the tension was carried out is defined without a shadow mask slackening. As this condition, the creep elongation after carrying out maintenance for 60 minutes at 450 degrees C was measured, having applied 2 to the shadow mask material 196Ns [/mm] load stress. If this creep elongation is 0.3% or less, after a shadow mask is built into the picture tube, it is the shadow mask material which can respond to the shadow mask of a flat mask.

表2

## 供試材の特性

試料番号	試験項目			判定	区分
	シャドウマスク素材時の特性		製品特性		
	引張強度 (N/mm <sup>2</sup> )	クリープ伸び (%)	クリープ伸び (%)		
基準値	588	0.3 以下	0.6 以下		
A	805.6	0.20	0.28	○	本発明
B	818.3	0.17	0.22	○	本発明
C	829.1	0.14	0.18	○	本発明
D	845.7	0.12	0.15	○	本発明
E	702.7	0.33	0.49	×	比較例
F	743.8	0.43	0.58	×	比較例
G	785.0	0.44	0.63	×	比較例

furthermore, the production process of the color picture tube — setting — melanism — heat-treatment of the baking processing performed after including in the picture tube, glass-sealing processing, etc. is performed following processing. For this reason, the creep elongation of a shadow mask is presumed to be a larger thing in practice than the elongation of said shadow mask material. For this reason, the elongation when turning the heating cooling repeat of maintenance three for 20 minutes at ordinary temperature and 450 degrees C was made to become 0.6% or less in view of the production process of the above-mentioned picture tube in

this invention, applying 196Ns /of load stress of 2 to a shadow mask material mm. It is because it is the shadow mask material which can respond to the shadow mask of a flat mask after a shadow mask is built into the picture tube if this elongation is 0.6% or less. Table 2 — the above — since this invention article is excellent also in which property, the notation of O has been shown in the column of a judgment as comprehensive evaluation. On the other hand, since the example article of a comparison which does not go within the limits of this invention is inferior in the property of one of the above, the notation of x has been shown as comprehensive evaluation.

Availability on industry The material for slot type shadow masks of this invention for the color picture tubes is excellent in etching nature, and since the picture tube incorporating a slot type shadow mask and it has the outstanding tensile strength and elevated-temperature creep strength, in the Braun tube of a certain shadow mask method, -izing of the mask side can be carried out [ flat ] from the former.

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[Translation done.]